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## Interstate Groundwater Resources: The Federal Role

John D. Leshy\*

### Introduction - An Overview of the Groundwater Resource

Extraction of groundwater has grown enormously in the last several decades, most dramatically in the years following World War II, after rural electrification and the invention of the high-speed centrifugal pump allowed pumping on a massive scale. In 1950 about 38 million acre-feet ("MAF") of groundwater was extracted; by 1980 the amount had risen to 93 MAF. Extractions declined somewhat to about 86 MAF in 1995, but then increased to a new high of 93.4 MAF in 2000, probably influenced by regional droughts in the late 1990s.<sup>1</sup> That volume of water is nearly enough to cover the entire land surface of the state of California one foot deep.

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\* Harry Sunderland Distinguished Professor of Law, U.C. Hastings College of the Law. This paper grew out of remarks delivered at the ABA's Environment, Energy and Resources Section's 26th annual water law conference in San Diego in February 2008. It draws from and builds upon my earlier article, *The Federal Role in Managing the Nation's Groundwater*, 11 HASTINGS W.-NW. J. ENV'T'L L. & POL'Y 1 (2004), and the groundwater, interstate/international, and federal law chapters I prepared for Joseph L. SAX, BARTON H. THOMPSON, JOHN D. LESHY & ROBERT H. ABRAMS, *LEGAL CONTROL OF WATER RESOURCES: CASES AND MATERIALS*, Ch. 5, 8, 9, pp. 393-520, 799-1008 (4<sup>th</sup> ed. 2006). I was the beneficiary of able research assistance in the fall of 2007 by Michael Sugar, a student at Harvard Law School, and in the spring of 2008 by Laurie Mikkelsen, a student at the University of California, Hastings College of the Law. Groundwater seems to be spelled as one word or two words (with or without hyphen) with about equal frequency. Because I believe, as the engineer's joke goes, "ground water" is what you get when you put ice in a blender, I use a single word unless a quotation uses the two-word formulation.

1. SUSAN S. HUTSON, NANCY L. BARBER, JOAN F. KENNY, KRISTIN S. LINSEY, DEBORAH S. LUMIA, & MOLLY A. MAUPIN, *ESTIMATED USE OF WATER IN THE UNITED STATES IN 2000* 1 (U.S. Geological Survey Circular 1268, 2004), *available at* <http://pubs.usgs.gov/circ/2004/circ1268/pdf/circular1268.pdf> (last visited Mar. 30, 2008). Data collection for the next report, on water use in 2005, is in progress.

About half the U.S. population uses groundwater for drinking.<sup>2</sup> Nearly half of all water used in irrigated agriculture is groundwater, accounting for more than two-thirds of the total volume of groundwater extracted in 2000.<sup>3</sup> While water and oil are two natural resources vital to our way of life, the annual volume of groundwater extracted in the U.S. is more than one hundred times greater than the volume of oil Americans consume.<sup>4</sup>

Besides the availability of relatively cheap electricity and powerful pumps, the reasons for growing dependence on groundwater are not hard to find. From a utilitarian perspective, groundwater has a number of advantages over surface water. There's much more of it. Of all unfrozen freshwater found in the Earth's "hydrosphere" (all water and water vapor occurring beneath, on, or above the Earth's surface), about 95 percent is groundwater.<sup>5</sup> It is widely found in both the humid East and the arid West. Because it is often available at or near its place of use, groundwater may be more efficient to use than surface water, needing fewer surface storage and conveyance facilities. There are no evaporation losses as with surface

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2. *Id.* at 16-19. Nearly all the people in the U.S. not serviced by a public water provider (about 15% of the total population) obtain their water from groundwater withdrawals. Public water providers now derive well over one-third of their supplies from groundwater. In the western states, 96 percent of Idaho residents and 90 percent of Montana residents depend on groundwater for domestic needs. *See Gone to the Well Once Too Often: The Importance of Ground Water to Rivers in the West*, TROUT UNLIMITED'S WESTERN WATER PROJECT, February 2007, at 5, available at [http://www.tu.org/atf/cf/%7B0D18ECB7-7347-445B-A38E-65B282BBBD8A%7D/groundwater\\_web.pdf](http://www.tu.org/atf/cf/%7B0D18ECB7-7347-445B-A38E-65B282BBBD8A%7D/groundwater_web.pdf) (last visited Mar. 30, 2008).

3. HUTSON, ET AL., *supra* note 2, at 4, 39, 40. Not surprisingly, greater volumes of groundwater tend to be used in the West. California accounts for nearly one-fifth of the national total, followed by Texas, Nebraska, Arkansas, Florida, Idaho, Kansas, and Arizona. More than two-thirds the total national volume of groundwater withdrawal is in these eight states. *Id.* at tbls. 2, 4. Irrigation uses 90 percent of Colorado's total withdrawal of groundwater and 79 percent of Arizona's. *See Gone to the Well Once Too Often*, *supra* note 3, at 4.

4. In 2004 the United States consumed somewhat more than 20 million barrels of oil per day, or about 7.3 billion barrels over the year. At 42 gallons per barrel, that is approximately 307 billion gallons, or about 940,000 acre-feet of oil, compared to about 93 million acre-feet of groundwater extracted annually in the United States.

5. RALPH HEATH, BASIC GROUND-WATER HYDROLOGY 1 (U.S. Geological Survey Water-Supply Paper No. 2220, 1998). For example, California has about 425 million acre-feet of available groundwater, while all of its surface water reservoirs combined can store only about one-tenth that amount. Lester Snow & Anthony Saracino, *The CALFED Ground Water Program*, in PROCEEDINGS OF THE 21ST BIENNIAL GROUND WATER CONFERENCE 5 (Water Resources Center Report No. 95, 1998). Groundwater accounted for about 40 percent of the total water withdrawals in California in 2000.

reservoirs,<sup>6</sup> and techniques for deliberately recharging aquifers for extraction later have advanced measurably in recent years. Groundwater is less reliant than surface flows upon precipitation, with its seasonal and annual variations, and thus is more dependable.

There are some offsetting disadvantages. First, there is the cost of drilling wells and of electricity to drive pumps. Water is, after all, quite heavy: about 240 gallons weighs a short ton; an acre-foot, about 1,359 short tons. In some areas, retrievable groundwater is so far below the surface that it is not cost-effective to pay for the pump "lift" to the surface.<sup>7</sup> Second, some aquifers are "recharged," or replenished, very slowly or not at all, and artificial recharge may not be possible. Pumping water from these aquifers may amount to mining a non-renewable resource, much as petroleum or gold is mined. Third, much groundwater is connected hydrologically to surface waters; in fact, the U.S. Geological Survey now estimates that groundwater is the source of almost 40 percent of the streamflow in the entire country.<sup>8</sup> As groundwater extraction increases, surface streams may dwindle or disappear, and rights to use water from those streams may go unsatisfied, even though typically they were established first. Fourth, some groundwater is of poor quality, and generally speaking, the deeper one goes the poorer the quality, because as the temperature increases with depth, the more chemicals dissolve out of the surrounding rock into the water. Fifth, in some situations groundwater withdrawals may cause the surface of the earth to subside, which can damage or destroy surface structures such as homes or highways.<sup>9</sup>

With such heavy use, it is not surprising that many areas of the United States are experiencing ground-water depletion,<sup>10</sup> problems and

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6. Lake Mead, with its large surface area in the hot desert southwest, evaporates around one million acre-feet of water (5 to 7 feet off the surface) every year. That's more than three times what the city of Phoenix, serving well over one million people, uses in the same time period.

7. Pumping water consumes an enormous amount of electricity. See RONNIE COHEN, BARRY NELSON & GARY WOLFF, *ENERGY DOWN THE DRAIN 4* (Natural Resources Defense Council and Pacific Institute, 2004), available at <http://www.nrdc.org/water/conservation/edrain/edrain.pdf> (last visited Mar. 30, 2008).

8. DAVID W. MOODY, JERRY CARR, EDITH B. CHASE & RICHARD W. PAULSON, *NATIONAL WATER SUMMARY, 1986 3* (U.S.G.S., Water Survey Paper 2325, 1988).

9. While other processes can cause subsidence, more than 80 percent of the subsidence in the U.S. is believed to be related to groundwater withdrawals. D.L. GALLOWAY, ET AL., *LAND SUBSIDENCE IN THE UNITED STATES 107* (U.S.G.S. Circular # 1182, 1999).

10. *GROUND-WATER DEPLETION ACROSS THE NATION 1* (U.S. Geological Survey Fact Sheet 1203-03, November 2003).

controversy.<sup>11</sup> Nevertheless, groundwater will likely become ever more important. This is especially true if, as seems increasingly likely, we are seeing the end of decades of relatively stable and favorable climatic conditions in most of the country — not to mention the possible impacts of greenhouse gas accumulations.

### **Groundwater and Surface Water**

For a long time it has been known that groundwater can have relatively direct connections to surface water,<sup>12</sup> but its contributions to stream flow, wetlands and surface vegetation are "masked and . . . impossible to observe directly."<sup>13</sup> Detailed information about the connections has long been lacking, as has been the desire to obtain it. Until groundwater began to be extracted in large quantities, there were relatively few situations in which the extraction was significant enough to threaten surface springs and streams. As a result, little effort was made to understand the nature of these connections sufficient to allow groundwater and surface water to be managed in a genuinely integrated fashion. In short, it was both easy and in some sense necessary to turn a blind eye to whatever connections existed.

That is plainly no longer the case. Indeed, the National Water Commission 35 years ago called the need to integrate the management of surface water and groundwater one of the three principal problems in groundwater law, management and administration.<sup>14</sup> The complex interrelationship poses regulatory challenges of the first magnitude, with which many jurisdictions are now grappling.<sup>15</sup>

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11. Professor Robert Glennon has documented some of these in *WATER FOLLIES* (Island Press, 2002); see also *Gone to the Well Once Too Often*, *supra* note 3, at 8. An emerging problem with interstate dimensions is the pumping of groundwater to facilitate the extraction of methane from coal beds in Wyoming and some other parts of the west. See, e.g., *Gone to the Well Once Too Often*, *supra* note 3, at 6-16.

12. Early 20th century water law treatise writers like Samuel Wiel were quite aware of it. His article, *Need for Unified Law for Surface and Underground Water*, 2 S. CAL. L. REV. 358, 369 (1929), presciently warned that the law "cannot prosper" in "ignorance or disregard" of the connection between ground and surface water. See also John Leshy & James Belanger, *Arizona Law Where Ground and Surface Water Meet*, 20 ARIZ. ST. L.J. 657, 658-59, 682-84 (1988).

13. Marcus Moench, *Groundwater: The Challenge of Monitoring and Management*, THE WORLD'S WATER 2004-2005, BIENNIAL REPORT ON FRESHWATER RESOURCES 79, 79 (Pacific Institute, 2005).

14. NATIONAL WATER COMMISSION WATER POLICIES FOR THE FUTURE 232 (1973). The others were groundwater mining and quality problems.

15. See, e.g., *Gone to the Well Once Too Often*, *supra* note 3, at 8-13.

While groundwater is linked to surface water in many situations, it behaves differently from surface water. Confined to pore spaces in geological beds, groundwater tends to move much more slowly than surface water. As a result, the impact of withdrawals from a well on other wells in the vicinity, or on the flows of watercourses on the surface, may not be perceived for months, years, or even decades.<sup>16</sup> Also, groundwater aquifers may recharge (replenish themselves) at widely differing rates. Some may consist mostly of water deposited over geological time (what some call "fossil" water) and be exhaustible much as oil and gas deposits are. Sometimes a number of different aquifers may be found in different subsurface layers, connected to each other in complex ways, affecting both flow and recharge.

As a National Research Council report put it, "ground water systems are difficult to observe and describe, not only because they are hidden from view, but also because they are three-dimensional and often very heterogeneous."<sup>17</sup> In fact, the more that is learned about subsurface hydrology, the more complex it may become. The scientific discipline that studies it, known as hydrogeology, increasingly relies on computer modeling. Indeed, groundwater modeling is practically an essential tool to manage groundwater intelligently. Unfortunately, in general, much less is known about groundwater — both its uses and its *in situ* characteristics — than surface water. A number of jurisdictions have never required all groundwater wells to be registered or their withdrawals measured and reported.<sup>18</sup> Such information deficiencies necessarily make models less accurate.

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16. See, e.g., HEATH, *supra* note 6, at 14 (comparing the rate of movement of groundwater to "the movement of water in the middle of a very large lake being drained by a very small stream"). Groundwater velocity commonly ranges from one meter per day to one meter per year. W. KENNETH HAMBLIN & ERIC H. CHRISTIANSEN, *EARTH'S DYNAMIC SYSTEMS* 325 (9th ed. 2001).

17. NATIONAL RESEARCH COUNCIL, *GROUND WATER MODELS: SCIENTIFIC AND REGULATORY APPLICATIONS* 219 (1990). Moench, *supra* note 14, at 80, observes that assessing aquifer pumping and recharge capacity requires "quantitative estimates of deep groundwater inflow from other aquifers, groundwater discharge to streams, evapotranspiration by plants and a wide variety of other factors . . . [which] often vary from year to year."

18. Many states have, finally, adopted well registration laws in recent decades, but some do not require periodic reporting on withdrawals. Equally important, most jurisdictions with well registration requirements exempt wells considered "small" and not worth the time and trouble (including hostility from the well-owners) to gather information about, much less regulate. But many states exempt wells that have a much higher capacity than simply serving an average family; e.g., Missouri exempts wells pumping less than 100,000 gallons per day. If pumped continuously,

## Groundwater and the Law

Generally speaking, allocation of rights to both groundwater and surface water is governed primarily by state law. The legal doctrines states apply to groundwater tend to be much more variegated than those they apply to surface water. That is, states tend to follow one of two basic legal regimes (riparian or prior appropriation) for surface water. But five different groundwater legal doctrines command some support across the 50 states: capture, American reasonable use, correlative rights, the Restatement rule, and prior appropriation. Moreover, especially in recent years, statutes have altered common law doctrines, either statewide or in smaller geographic units. Increasingly, states are giving special governmental districts jurisdiction to manage groundwater in particular geographic areas according to principles somewhat at variance with conventional legal doctrines. Also, the groundwater law doctrines in many states are, compared to their surface water laws, underdeveloped, with some basic questions about the nature of rights to pump groundwater unresolved.

Moreover, states also vary widely in whether and how they account for hydrological connections between groundwater and surface water. As a long-time Colorado water lawyer once put it, the law in many jurisdictions tried to create a "hydrologic bicycle" out of the hydrologic cycle,<sup>19</sup> assigning water rights to groundwater and surface water separately without taking adequate account of the fact that the water involved is often part of a single, hydrologically integrated source.

Federal law adds to these complexities. The federal common law of water rights developed under the principles of *Winters v. United States*<sup>20</sup> has some application to groundwater as well as surface water, even though the Supreme Court once sidestepped the opportunity to clarify whether *Winters* rights extend to groundwater.<sup>21</sup> But some basic questions about how this doctrine applies to groundwater and hydrologically related surface water are not yet resolved. Federal environmental laws like the Clean Water Act and the Endangered Species Act also can, in particular circumstances, have a

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such a well would yield 100 acre-feet per year, enough to serve well over 100 families at average rates of domestic consumption. See SAX, ET AL., *supra* note 1, at p. 408-09; see also *Gone to the Well Once Too Often*, *supra* note 3, at 14-15.

19. Raphael Moses, *Basic Groundwater Problems*, 14 ROCKY MTN. MIN. L. INST. 501, 503 (1968).

20. *Winters v. United States*, 207 U.S. 564 (1908).

21. *Cappaert v. United States*, 426 U.S. 128, 142-43 (1976). Most lower courts have held that the doctrine does apply to groundwater, and none of the case law or commentary has so far unearthed any persuasive reason for a different result. See SAX, ET AL., *supra* note 1, at 971.

good deal to say about how groundwater, particularly that hydrologically related to surface water, is managed.

### Groundwater and State Lines

Like surface water and many other natural resources, groundwater aquifers do not respect state lines. There are indications that, the more we learn about groundwater, the more we learn it is connected to surface watercourses, which themselves often cross state lines.<sup>22</sup> Pumping from a deep aquifer in southwestern Wyoming or northwestern New Mexico might affect the flow of the Colorado River all the way down to Mexico, for example. Moreover, it seems the more we learn about the subsurface, the more likely we may find that seemingly isolated local aquifers connect to other aquifers that have connections across state lines through groundwater or surface water. All this means that groundwater likely has a more common interstate character than might first be appreciated.<sup>23</sup>

Interstate groundwater issues have come to public attention in several areas of the country. The poster child of groundwater use is the Ogallala

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22. See, e.g., Alan H. Welch, et al., *Water Resources of the Basin and Range Carbonate-Rock Aquifer System, White Pine County, Nevada, and Adjacent Areas in Nevada and Utah* (U.S.G.S. Open-File Report 2007-5261) (available at <http://pubs.usgs.gov/of/2007/5261/>); James E. Deacon, et al., *Fueling Population Growth in Las Vegas: How Large-Scale Groundwater Withdrawal Could Burn Regional Biodiversity*, 57 BIOSCIENCE 688, 688 (Sept. 2007) (interconnected aquifers in the Great Basin extend from near Salt Lake City, Utah, to Death Valley, CA).

23. A useful overview of the Nation's aquifers, showing the extent to which they disrespect political boundaries, can be found at <http://nationalatlas.gov/natlas/Natlasstart.asp>. See also *Gone to the Well Once Too Often*, *supra* note 3, at 9. An early survey of problems with interstate groundwater aquifers is found in Morton W. Bittinger and E. Bruce Jones, *Interstate and International Aquifers*, 8 WATER RES. BULL. No. 2 386 (April 1972). Transboundary groundwater resources have been subdivided into four categories: (1) an isolated aquifer not linked to other aquifers or surface water which is bisected by a state boundary; (2) an aquifer lying wholly within the territory of one state but hydraulically linked to a river that crosses a state boundary; (3) an aquifer lying wholly within the territory of one state but hydrologically linked to an aquifer in a neighboring state; and (4) an aquifer situated entirely within the territory of one state but with its recharge zone in another state. JULIO A. BARBERIS, *INTERNATIONAL GROUNDWATER RESOURCES LAW*, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, FAO LEGISLATIVE STUDY NO. 40, ROME, ITALY (1986). Barberis was speaking of international boundaries but the categorization is equally applicable to state boundaries within the United States. Others find six or more categories. See Gabriel Eckstein & Yoram Eckstein, *A Hydrogeological Approach to Transboundary Ground Water Resources and International Law*, 19 AM. U. INT'L. L. REV. 201, 235-48 (2003).



Aquifer, a gigantic aquifer that underlies large portions of Kansas and Nebraska, and smaller portions of Colorado, New Mexico, Oklahoma, South Dakota, Texas and Wyoming. The largest in North America, it holds enough water to fill Lake Huron, is tapped by nearly 200,000 wells pumping 18 million acre-feet a year to irrigate fourteen million acres (about 20 percent of all the irrigated land in the U.S.), and supplies drinking water to about four-fifths of the people living over it. With little natural recharge — if drained it would, because of sparse precipitation and an impervious geological layer between much of it and the surface, take 6,000 years to refill — the Ogallala has been mined for the past half-century. In some overlying areas the depth to water has increased so much that pump lifts have reached economic limits.<sup>24</sup>

Other areas where interstate groundwater issues have emerged include the Sparta aquifer underlying parts of Arkansas, Louisiana, Mississippi and Tennessee,<sup>25</sup> the sandstone aquifer underlying the Chicago area and eastern Wisconsin; and the Spokane Valley-Rathdrum Prairie Aquifer under several hundred square miles of northern Idaho and eastern Washington, which is the sole source of drinking water for most of the 400,000 people who live in the area.

### **Interstate Watercourses and the Law**

There is a substantial body of federal law on interstate watercourses.<sup>26</sup> In a nutshell, federal law provides three ways to effectively apportion or otherwise address conflicts involving them between or among the states. First, the states can, with the consent of Congress, address such matters by interstate compact.<sup>27</sup> Second, the Supreme Court can address them by applying the "equitable apportionment" doctrine of federal common law.<sup>28</sup> Both these mechanisms directly involve the states as sovereign entities; that

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24. See, e.g., Robert R.M. Verchick, *Dust Bowl Blues: Saving and Sharing the Ogallala Aquifer*, 14 J. ENVTL. L. & LITIG. 13, 20 (1999).

25. The State of Mississippi has sued the city of Memphis alleging the latter is pumping excessively from the interstate aquifer to Mississippi's detriment; the district court's dismissal of the case is currently under review in the Fifth Circuit Court of Appeals. *Hood ex rel. Mississippi v. City of Memphis, Tenn.* 2008 WL 346102 (N.D. Miss. Feb. 6, 2008).

26. See SAX, ET AL., *supra* note 1, at 835-91.

27. A few dozen interstate compacts dealing with water have been entered in force. See Douglas Grant, *Water Apportionment Compacts Between States*, in 4 WATERS AND WATER RIGHTS § 46.01 (Robert Beck ed., 2004).

28. On compacts and equitable apportionment decrees, see SAX, ET AL., *supra* note 1, at 842-78.

is, private water users cannot achieve compacts or litigate on behalf of states in the Supreme Court.<sup>29</sup>

Third, Congress can unilaterally address such matters by ordinary legislation. It can do this both directly (by legislation apportioning or otherwise aimed at particular interstate watercourses<sup>30</sup>), and indirectly, by enacting federal regulatory legislation that effectively supersedes existing interstate compacts, equitable apportionment decrees, or other arrangements. This latter practice is not well appreciated, but it rests mostly on the notion that a compact is federal law of the same general stature as other federal laws, and a particular Congress (such as one approving an interstate compact) cannot bind a future Congress.<sup>31</sup> Thus, enactment of the federal Clean Water Act probably superseded substantive provisions of several interstate compacts providing for pollution control of individual streams.<sup>32</sup> The Endangered Species Act almost certainly has the same effect.<sup>33</sup> And because equitable apportionment decrees are expressions of federal common law,<sup>34</sup> they too can be modified or overridden by Congress.

Other means of resolving interstate disputes have been used, but they may not provide binding permanent solutions. For example, the federal courts have on rare occasions been called upon to resolve water disputes among private parties claiming conflicting rights to an interstate watercourse.<sup>35</sup> In such cases the courts have generally borrowed state water

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29. *Id.* at 873.

30. See *Arizona v. California*, 373 U.S. 546, 565-66 (1963).

31. See, e.g., *Fletcher v. Peck*, 10 U.S. (6 Cranch) 87, 135 (1810) ("one legislature cannot abridge the powers of a succeeding legislature"); *United States Trust Co. v. New Jersey*, 431 U.S. 1, 45 (1977) (Brennan, J. dissenting) (One of the "fundamental premises of our popular democracy is that each generation of representatives can and will remain responsive to the needs and desires of those whom they represent . . . [and thus] new legislators will not automatically be bound by the policies and undertakings of earlier days.").

32. See Jerome C. Muys, George William Sherk, Marilyn C. O'Leary, *The Utton Transboundary Resources Center Model Interstate Water Compact*, 47 NAT. RES. J. 17, 109-15, esp. at 11, n.130 (2007); see also GEORGE WILLIAM SHERK, *DIVIDING THE WATERS: THE RESOLUTION OF INTERSTATE WATER CONFLICTS IN THE UNITED STATES* 49-58 (2000).

33. Muys, et al., *supra* note 33, at 112; *Riverside Irr. Dist. v. Andrews*, 568 F. Supp. 583, 590 (D. Colo. 1983), *aff'd on other grounds*, 758 F.2d 508 (10th Cir. 1985).

34. See, e.g., *Kansas v. Colorado*, 206 U.S. 46, 97-98 (1907).

35. SAX, ET AL., *supra* note 1, at 874-78. Some of these lawsuits have involved a state as well as private parties, and some of the litigation has led to equitable apportionment suits between states in the U.S. Supreme Court. See, e.g., *Wyoming v. Colorado*, 259 U.S. 419 (1922); *Colorado v. New Mexico*, 459 U.S. 176 (1983).

law doctrines and applied them as federal common law.<sup>36</sup> Also, states may enter into agreements with each other regarding interstate watercourses without any federal involvement, but such arrangements have limited effect without some imprimatur of federal law.<sup>37</sup>

In short, effective management of interstate water resources over the long term almost surely needs a dose of federal law.

### **Interstate Groundwater and the Law**

The mechanisms and legal principles discussed in the previous section have been developed and fleshed out almost entirely in the context of surface water. There is not much room to doubt, however, that they can and will likely be applied to groundwater where it has interstate dimensions.<sup>38</sup>

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36. See, e.g., *Bean v. Morris*, 221 U.S. 485 (1911). This solution was readily available because the pertinent states seem to have applied the same general principles of water law. For a discussion of what might happen when the pertinent states apply different water law doctrines, see Douglas Grant, *Private Interstate Suits*, § 44.05(b), in 4 *WATERS AND WATER RIGHTS* (Robert Beck ed. 2001) (noting the decided cases “offer only limited guidance” on the subject). See also Ward H. Fischer, *Management of Interstate Ground Water*, 7 NAT. RES. L. 521, 525-28 (1974).

37. It is also relevant here that the “dormant” aspect of the interstate commerce clause of the U.S. Constitution has been applied by the Supreme Court to sharply limit the ability of a state to prevent water extracted within its borders from being sent out of state, unless Congress approves. *Sporhase v. Nebraska*, 458 U.S. 941, 960 (1982). There has been some lively scholarly debate about the relationship between the dormant commerce clause and the equitable apportionment doctrine, with most arguing that the latter is a better method of handling interstate groundwater conflicts. See, e.g., Albert E. Utton, *Sporhase, El Paso, and the Unilateral Allocation of Water Resources: Some Reflections on International and Interstate Groundwater Law*, 57 U. COLO. L. REV. 549 (1986).

38. More broadly, the federal government has ample constitutional authority to regulate or otherwise influence groundwater management and use regardless of whether the resource has an interstate character. The Supreme Court said in *Sporhase v. Nebraska* that the U.S. Constitution’s Commerce Clause gives Congress “affirmative power . . . to implement its own policies concerning [groundwater] regulation. . . . Ground water overdraft is a national problem and Congress has the power to deal with it on that scale.” 458 U.S. 941, 953-54 (1982) (dictum). While the case concerned pumping from the multi-state Ogallala aquifer, the Court noted its interstate character only to “confirm” the substantial federal interest in groundwater. The Court bottomed that federal interest on the fact that most water, including groundwater, is used for agriculture which operates in a worldwide market and provides what the Court called the “archtypical example of commerce among the

### Past Federal Actions Regarding Interstate Groundwater

The federal government has long been relatively quiescent about groundwater, whether of interstate dimensions or not. There is one small but important exception: The groundwater resources program of the United States Geological Survey (USGS) attempts to systematically gather nationwide data about groundwater withdrawals and aquifer characteristics. The amount of money devoted to this important task — less than \$10 million per year — is trifling, given the magnitude and importance of the resource.<sup>39</sup>

Apart from data-gathering, federal actions vis-à-vis interstate groundwater have had a hodgepodge character. Despite the notoriety of declining water levels in the Ogallala Aquifer, for example, Congress's response has been minimal. In 1983, it authorized a High Plains States Groundwater Demonstration Program, directing the Interior Department's Bureau of Reclamation to look into ways to recharge the aquifer.<sup>40</sup> Prodded by a federal court decision, the Internal Revenue Service has allowed groundwater pumpers from the Ogallala, but not elsewhere, a cost depletion deduction.<sup>41</sup>

Elsewhere, Congress in 1972 authorized the "Closed Basin" federal groundwater pumping project to help Colorado deal with a nearly one million acre-foot deficit it had run up under the 1939 Rio Grande Compact with Texas and New Mexico. This project pumps groundwater from the northern portion of the San Luis Valley, separated from the rest of the Valley by a low alluvial fan, and transports it south to discharge into the Rio Grande River.<sup>42</sup>

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several States for which the Framers of our Constitution intended to authorize federal regulation." *Id.* at 953.

39. USGS's total budget for gathering and analyzing information about water commands something less than \$100 million of federal tax revenues; state and local governments contribute matching funds to bring the total sum expended on the enterprise to something more than \$200 million per year. *See* GROUND-WATER DEPLETION ACROSS THE NATION, *supra* note 11.

40. High Plains States Groundwater Demonstration Program, 43 U.S.C. 390g (2008). The title is a bit of a misnomer. Reflecting various cross-currents in water politics, the legislation also authorized demonstration groundwater recharge projects in other reclamation states outside the High Plains, and prohibited using any program funds for recharge projects that would "utilize water originating in the drainage basin of the Great Lakes."

41. SAX, ET AL., *supra* note 1, at 488-89.

42. Pub. L. No. 92-514, 86 Stat. 964 (1972). Although not directly applicable to interstate groundwater, Congress two years ago directed the Interior Department to establish a joint "Transboundary Aquifer Assessment Program" with Mexico to

To date, the most interesting piece of federal legislation dealing with interstate groundwater is found in the rather innocuously named Lincoln County Conservation, Recreation and Development Act of 2004. It is discussed in more detail further below.<sup>43</sup>

### **Other Federal Actions Regarding Interstate Groundwater**

Only a handful of interstate compacts refer expressly to groundwater.<sup>44</sup> Litigation in the original jurisdiction of the Supreme Court in recent years has, however, effectively extended compacts that are silent on the subject to include groundwater hydrologically related to the surface water addressed in the compact.<sup>45</sup> Similarly, although the Supreme Court has not yet been asked to apportion any interstate aquifers, groundwater hydrologically

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provide the informational basis for addressing serious groundwater and related surface water problems along the border. Pub.L. 109-448, 120 Stat. 3328 (2006). The Bush Administration's proposed FY 2009 budget would delete funding for this program.

43. Lincoln County Conservation, Recreation and Development Act of 2004, Pub.L. No. 108-424, 118 Stat. 2403 (2004).

44. See Douglas Grant, *Water Apportionment Compacts Between States*, in 4 *WATERS AND WATER RIGHTS* § 46.03 (Robert Beck ed., 2004).

45. *Kansas v. Colorado*, 514 U.S. 673 (1995); 533 U.S. 1 (2001); 543 U.S. 86 (2004) (Arkansas River Compact of 1949; Supreme Court approved an award of damages to Kansas for Colorado's post-Compact increases in groundwater pumping); *Kansas v. Nebraska*, 538 U.S. 720 (2003) (Republican River Compact of 1943; Kansas's claim that upstream Nebraska was stealing Kansas's entitlement by pumping groundwater was settled by, among other things, putting a moratorium on new wells in certain locations in Nebraska). See also *Arizona v. California*, 376 U.S. 340, 341 (1964) (decree in statutory apportionment case specified, without elaboration, that it applies to "water drawn from the mainstream [of the Colorado river] by underground pumping"). In February 2008, the U.S. Supreme Court accepted the invitation of the Solicitor General to take up a dispute between Montana and Wyoming which, among other things, raises the question about whether and how groundwater pumping should be accounted for under the Yellowstone River Compact of 1950. *Montana v. Wyoming*, 127 S. Ct. 2294 (May 14, 2007). One of Montana's complaints is that pumping in Wyoming to extract coalbed methane in tributary basins of the Yellowstone (the Tongue and Powder Rivers) has depleted surface water flows. The developers of a recent model interstate water compact noted a "strong consensus" that groundwater connected to surface flows should be expressly included in any compact, and expressed the view that the Supreme Court is "highly likely to imply its inclusion unless it is expressly excluded with precise language." See Muys, et al., *supra* note 33, at 28; see also *id.* at 71-73. The compact and commentary may also be found at [http://uttoncenter.unm.edu/pdfs/Model\\_Compact\\_NRJ\\_Final.pdf](http://uttoncenter.unm.edu/pdfs/Model_Compact_NRJ_Final.pdf) (last visited Mar. 30, 2008).

connected to surface water is, as in compact litigation, beginning to be swept within the ambit of equitable apportionment decrees.<sup>46</sup>

### The Federal Role in Interstate Groundwater - Some Tools

The national government has, as I have noted before, rarely taken the initiative to address groundwater problems across the country, whether or not they have interstate connections.<sup>47</sup> Its relative torpor is explained by several factors, including a long (though hardly uniform<sup>48</sup>) deference to state water law and its lack of enthusiasm for building groundwater projects compared to conventional surface water projects. There is, however, room to doubt whether the national government can or should remain relatively passive in a climate-disturbed era. Water supply and management systems are under increasing stress. Reliance on groundwater is likely to grow as surface water supplies become more precarious.

Groundwater that has an interstate dimension is a logical place for federal action because, as noted earlier, effective interstate management requires some imprimatur of federal law. If the national government wanted to take a more assertive role here, there is no doubt about its authority to do so.<sup>49</sup> It has many levers to exercise. The following lists some steps it could

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46. See *Nebraska v. Wyoming*, 515 U.S. 1, 14 (1995); 534 U.S. 40, 53 (2001) (approving a settlement that constrained upstream Wyoming's pumping of hydrologically connected groundwater, which the settlement defined as water pumped from a well "so located and constructed that if water were intentionally withdrawn continuously for forty years, the cumulative stream depletion would be greater than or equal to 28% of the total groundwater withdrawn by that well"). In *Washington v. Oregon*, 297 U.S. 517 (1936), the state of Washington sued its neighbor to adjudicate the waters of the Walla Walla River and alleged, among other things, Oregon residents were pumping groundwater to its detriment. The Court rejected the claim, approving the finding of the Special Master that Washington offered "no satisfactory proof that the use of the water from these wells materially lessens the quantity of water available for use within the State of Washington." 297 U.S. at 526.

47. John D. Leshy, *The Federal Role in Managing the Nation's Groundwater*, 11 HASTINGS W.-NW. J. ENV'T L. & POL'Y 1, 1 (2004). An earlier treatment is Zachary A. Smith, *Federal Intervention in the Management of Groundwater Resources: Past Efforts and Future Prospects*, 15 PUBLIUS 145 (Winter, 1985).

48. Reed Benson, *Deflating the Deference Myth: National Interests vs. State Authority Under Federal Laws Affecting Water Use*, 2006 UTAH L. REV. 241; Bruce A. Machmeier, Note: *Federal Acquisition of Non-Reserved Rights after New Mexico*, 31 STAN. L. REV. 885, 909 n. 20 (1979) (citing 25 federal statutes not deferring to state water law).

49. See generally *supra* note 38, which notes that federal authority over groundwater is not dependent on the resource crossing state lines.

take, approximately in order of their political feasibility, with the most widely acceptable first.

Current information gaps about groundwater — its occurrence and characteristics (including recharge rates, connections to surface water, and so forth) and even current extraction rates — are enormous. As the U.S.G.S. has noted, although many aquifer systems are monitored within states, "coordinated water-level monitoring generally has not been done for aquifers that cross State boundaries (the High Plains aquifer is an exception)."<sup>50</sup> Good information about groundwater would be very helpful in just about every possible effort to resolve interstate groundwater issues intelligently, whether by negotiation, litigation, congressional action, regulation, market-oriented transactions, or otherwise. One would therefore hope to find general agreement that the U.S. should expand its important information-gathering role. The U.S.G.S. is widely respected and its credibility is invaluable in such a contentious area. It seems short-sighted in the extreme that the U.S. currently spends only a few million dollars a year on gathering this information.<sup>51</sup>

Beyond information gathering, the national government has a number of carrots and sticks at its disposal to promote resolution of interstate groundwater conflicts. For one thing, it will likely be called upon to build or contribute funds to projects necessary to utilize or manage interstate groundwater resources. In so doing it could implement the mostly ignored but still cogent recommendations of the National Water Commission to use federal water project planning and operations to promote more sensible management of groundwater by states,<sup>52</sup> particularly to leverage them to work with other states to address groundwater management with interstate dimensions.

The national government could also use its significant powers over the use of federal lands, which are a significant part of the land base of most western states, to promote intelligent management of interstate aquifers. Many, probably most, schemes to make greater use of aquifers with interstate dimensions will require approval to use federal lands for pumping facilities, pipelines, monitoring wells, and so forth. The United States could condition use of its lands for such purposes on states reaching satisfactory

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50. U.S.G.S. Fact Sheet 1203-03, *supra* note 11, at 4. Moench, *supra* note 14, at 92, notes that serious investments are "almost never" made to gather and analyze data to gauge sustained yield of individual aquifers "unless they already have evidence of problems."

51. Currently, for example, U.S.G.S. receives data from groundwater monitors at only one site in the entire state of Utah, and only nine sites in Nevada. See <http://waterdata.usgs.gov/nwis/current/?type=gw> (last visited Mar. 30, 2008).

52. See John D. Leshy, *The Federal Role in Managing the Nation's Groundwater*, 11 HASTINGS W.-NW. J. ENV'T'L L. & POL'Y 1, 10-12 (2004).

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agreements regarding aquifer management. The U.S. can also use its leverage to see to it that such agreements protect any national interests involved, such as national security (e.g., the needs of military bases), the interests of Native Americans, and the environment (e.g., water quality, endangered species). There is a long history of the U.S. using its power over federal lands to influence state water management. Many decades ago, for example, its refusal to permit federal lands to be used to support non-federal water projects in Wyoming and New Mexico spurred states to negotiate interstate compacts on several western rivers, including the Colorado.<sup>53</sup>

The national government will also in many situations have federal-law-based water rights that may be implicated in withdrawals from interstate aquifers. Many federal reservations (e.g., national parks, monuments, wildlife refuges, conservation areas, and military bases) carry with them water rights that might require protection of hydrologically related groundwater. This was illustrated by the Supreme Court's unanimous decision in *Cappaert*, where the assertion of federal water rights halted a groundwater-based irrigation project on private land some miles away, even though the project had water rights perfected under state law.<sup>54</sup>

Some of the national government's regulatory programs also can directly affect the management of groundwater, including that with interstate dimensions. The Endangered Species Act, for example, has been brought to bear to force states to better manage groundwater withdrawals. The saga of the Edwards Aquifer in Texas demonstrated the power of the Act to change a deeply embedded culture of non-management of a crucial aquifer, albeit one without interstate dimensions.<sup>55</sup> The Clean Water Act and other regulatory schemes might also provide a mechanism for federal influence.

Finally, Congress could use its legislative authority to apportion or otherwise control management of aquifers between or among states. Of course, political factors (principally those growing out of the States' equal representation in the U.S. Senate) make this difficult, absent substantial agreement among the states involved.

The availability of these tools does not mean they need to be exercised. Local areas and states may take steps to address interstate groundwater problems without the direct assistance of the national

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53. See DANIEL TYLER, *SILVER FOX OF THE ROCKIES: DELPHUS E. CARPENTER AND WESTERN WATER COMPACTS* 119, 154, 169, 314 n. 58 (2003); William A. Paddock, *The Rio Grande Compact of 1938*, 5 U. DENV. WATER L. REV. 1, 13 (2001).

54. *Cappaert v. United States*, 426 U.S. 128, 136-37 (1976). The Court did not identify any interstate connection, but the aquifer involved may well have interstate dimensions. See sources cited *supra* note 23.

55. See, e.g., Todd H. Votteler, *Raiders of the Lost Aquifer? Or, the Beginning of the End of Fifty Years of Conflict Over the Texas Edwards Aquifer*, 15 TULANE ENVTL. L.J. 257 (2002).



government, even though they are not enforceable as federal law without the blessing of the United States.<sup>56</sup>

### **The Lincoln County, Nevada Legislation - A Harbinger for the Future?**

Congress recently provided a useful example of how it might exercise the tools at its disposal. In 2004, as part of a package dealing with a variety of public land management issues in eastern Nevada, Congress addressed a proposal by the Southern Nevada Water Authority (SNWA) to pump, and send south to the burgeoning metropolitan Las Vegas area, groundwater from several basin-and-range valleys in northeastern Nevada. The aquifer complex proposed to be tapped extends into Utah. Section 301 of the legislation promotes interstate cooperation in three significant ways.

First, information gathering: The legislation calls on USGS and the states to gather and analyze information about interstate groundwater basins that might be affected by the SNWA's plans.<sup>57</sup> The resulting report, released in December 2007, will likely have a great deal of influence over how that situation will be resolved.<sup>58</sup>

Second, federal land use: The legislation gives the SNWA a perpetual right-of-way across federal lands for constructing and operating a water conveyance system to bring water from the north down to Las Vegas.<sup>59</sup> But Congress attached the significant string that no groundwater from basins that cross state lines would be diverted for the project without an agreement from the two states involved. Specifically, section 301(e)(3) provides that "[p]rior to any transbasin diversion from groundwater basins located within" both Nevada and Utah, the two states "shall reach an agreement regarding the division of water resources of those interstate ground-water flow system(s) from which water will be diverted and used by the [Southern Nevada] project." The section also provides that the agreement "shall allow

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56. For an example where the federal government was not involved, see INTERAGENCY AGREEMENT IN THE MATTER OF THE COORDINATED MANAGEMENT OF THE PULLMAN-MOSCOW GROUND WATER AQUIFER (April 20, 1992), *available at* <http://www.fao.org/docrep/008/y5739e/y5739e0b.htm#bm11..2.1.1> (last visited Mar. 30, 2008).

57. Lincoln County Conservation, Recreation, and Development Act of 2004, Pub. L. No. 108-424, § 301(e)(1), 118 Stat. 2403, 2413-14 (2004), requires an investigation of the "ground water quantity, quality, and flow characteristics" of aquifers in White Pine and Lincoln Counties, Nevada, "and adjacent areas in Utah," to determine, among other things, "the approximate volume of water stored" in these aquifers, the "discharge and recharge characteristics" and "hydrogeologic and other controls that govern the discharge and recharge" of each aquifer system.

58. See sources cited *supra* note 23.

59. Lincoln County Conservation, Recreation, and Development Act of 2004, § 301(b)(2).

for the maximum sustainable beneficial use of the water resources and protect existing water rights."

Third, federal financial and other assistance: The legislation pays for the information-gathering out of an account funded by the sale of federal lands in the Las Vegas area, and waives a requirement to pay fair market rental value for the right-of-way across federal lands.<sup>60</sup>

In a nutshell, Congress furnished the SNWA with federal help for information gathering and analysis, federal funds, and federal lands for a right-of-way for project facilities, in return for which Nevada had to reach agreement with Utah on the management of the aquifer. It means that, if Nevada and Utah cannot agree, the SNWA cannot tap the interstate resource. Of course, Congress could simply repeal it, which would give the advantage to Nevada, and put Utah in the position of seeking judicial relief. Utah would, presumably, strenuously oppose this. Or Congress could apportion the aquifer itself, or otherwise specify the conditions under which the SNWA proposal would go forward.

Alternatively, either state could seek to invoke the Supreme Court's original jurisdiction to address the issue in equitable apportionment litigation. It is not clear whether the Supreme Court would agree to hear the case, for the Court has sometimes demanded a showing that the applicant state is suffering a real injury of serious magnitude to exercise its "extraordinary power . . . to control the conduct of one state at the suit of another."<sup>61</sup> Assuming such a showing could be made, the litigation might take many years to conclude. Whether time is a serious issue is not clear. SNWA's project is to be implemented in phases, and it may argue that only a later phase will directly reach the interstate aquifer.<sup>62</sup>

Although the Lincoln County legislation did not address it, the Nevada-Utah situation involves a fourth dimension noted above: the presence of federal-law-based (so-called *Winters*) water rights. The Great Basin National Park and several other protected areas of federal land, each

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60. *Id.* The Federal Land Policy and Management Act, 43 U.S.C. § 1764(g), does not provide for perpetual rights-of-ways, and requires that the holder of a right of way across federal land "shall pay in advance the fair market value thereof," with some limitations.

61. *New York v. New Jersey*, 256 U.S. 296, 309 (1921); *see also* SAX, ET AL., *supra* note 1, at 858-59, 871.

62. In April 2007, the Nevada State Engineer approved SNWA's application to appropriate groundwater in a valley lying wholly within Nevada (whose connection to interstate waters is not completely clear) for export to Las Vegas in the first phase of the project. SNWA had applied to pump and export 91,000 acre-feet a year, but the decision granted it the right to pump 40,000 acre-feet a year for 10 years, with monitoring, and signaled the possibility this could increase to 60,000 acre-feet if no harm was detected.

of which may have federal reserved water rights, are located in areas that might be affected by the SNWA's groundwater pumping and export plan.<sup>63</sup> When the SNWA applied to the Nevada State Engineer to appropriate groundwater in eastern Nevada to carry out its project, the federal government protested on the ground the appropriation could injure its *Winters* rights. In September 2006, however, the United States agreed to dismiss its protest after the parties reached a detailed agreement which, to simplify somewhat, set up committees to monitor the project's impact on federal water rights and make appropriate changes if unreasonable harm to those rights would result.<sup>64</sup>

How should interstate groundwater resources be managed, and rights to their use allocated among the interested states?

The answer is not self-evident. Sensible management of groundwater is different enough without considering state lines. The complex characteristics of aquifers, their connections to surface water, and the slow and somewhat uncertain movement of water within them all raise management challenges of the first order. The presence of state lines simply adds to the difficulty by bringing new sovereign entities into the picture.

There is, for example, the question of whether to take up these issues at all. States have found that establishing and operating regulatory machinery for managing groundwater in order to protect surface streams can be complicated and costly, in political as well as fiscal terms. This is a major reason why governments in many places have put off grappling with the challenge until a true crisis looms, such as irremediable contamination from saline intrusion.<sup>65</sup> Should there be some sort of cost-benefit analysis

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63. See Deacon, et al., *supra* note 23, at 695; see also Rob Dubuc, *Snake Valley to Las Vegas: Keep Your Pipes Out of Our Aquifer!* 27 J. LAND RESOURCES AND ENVTL. L. 151, 181-87 (2007). The 1986 legislation establishing Great Basin National Park specifically disclaimed any new implied federal water rights, but the Park included federal lands that had previously been set aside as a national forest and a national monument, and the legislation creating the Park did retain any water rights that "may have been associated with the initial establishment and withdrawal of Humboldt National Forest and the Lehman Caves National Monument," which were included in the Park upon its creation. 16 U.S.C. § 410mm-1(h).

64. Stipulation for Withdrawal of Protests (before the Nevada State Engineer, September 2006). The Stipulation did allow the United States to produce and comment on certain reports, including a U.S.G.S. report, PEGGY E. ELLIOTT, DAVID A. BECK, AND DAVID E. PRUDIC, CHARACTERIZATION OF SURFACE-WATER RESOURCES IN THE GREAT BASIN NATIONAL PARK AREA AND THEIR SUSCEPTIBILITY TO GROUND-WATER WITHDRAWALS IN ADJACENT VALLEYS, WHITE PINE COUNTY, NEVADA (Scientific Investigations Report 2006-5099). The stipulation has been criticized for lacking a "substantial amount of teeth." Dubuc, *supra* note 64, at 189-92.

65. *Id.* at 506-07.

applied to determine when the challenge has to be taken up in the context of interstate groundwater? Might it simply prove too costly to regulate groundwater in order to protect surface streams?<sup>66</sup> Or does the interstate character suggest that these problems be addressed sooner rather than later?

As noted earlier, federal law will, in the end, likely have a lot to say about how the interstate groundwater resource is managed. While federal law does not have to follow state water law, those crafting federal arrangements will naturally consider borrowing state law, especially if the affected states agree on the legal principles to be applied.<sup>67</sup> With groundwater, however, the affected states may not agree very often. Consider the Ogallala Aquifer: Texas still follows a capture rule (where priority is irrelevant), New Mexico and Colorado follow prior appropriation, and Nebraska follows correlative rights (where priority is sometimes relevant, sometimes not).<sup>68</sup>

Even where the states involved apply the same groundwater doctrine, there may be important differences in the pertinent legal rules. In the Nevada-Utah situation, for example, both states apply the prior appropriation doctrine to groundwater as well as surface water, but it is not clear whether they treat groundwater connected to surface water the same way.<sup>69</sup>

To the extent an interstate aquifer is renewable, should it be managed on something like a sustainable basis? If so, how should "sustainability" be defined? Strictly, so that withdrawals cannot exceed recharge? Or is some "mining" of the resource permissible? If an interstate aquifer has a negligible recharge rate, should a no-mining policy be followed even if the effect is to lock up from use what might be a huge volume of water? States have differing policies on such questions.<sup>70</sup>

There is also the problem of delayed effect because of the rate at which groundwater moves laterally through an aquifer. Pumping in one state may not affect wells in another state for years or decades. Conversely, it may

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66. Indeed, one groundwater expert has been quoted making the "dark and bold assertion" that nowhere on the planet has groundwater management genuinely succeeded. See Burke W. Griggs, *Does Groundwater Management Work?* 15 KAN. J.L. & PUB. POL'Y 391, 391 (2006) (referring to comments of Dr. Tushaar Shah).

67. SAX, ET AL., *supra* note 1, at 868-70.

68. *Id.* at 414-43.

69. See, e.g., GARY BRYNER AND ELIZABETH PURCELL, GROUNDWATER LAW SOURCEBOOK 39, 52 (Natural Resources Law Center (2003), available at <http://www.colorado.edu/Law/centers/nrlc/publications/Groundwater%20Law%20Sourcebook.pdf> (last visited Mar. 30, 2008)). See also *Salt Lake City v. Silver Fork Pipeline Corp.*, 5 P.3d 1206, 1213 n. 6 (Utah 2000); *Gone to the Well Once Too Often*, *supra* note 3, at 10.

70. See, e.g., SAX, ET AL., *supra* note 1, at 404-05 ("safe yield" is a slippery concept); 478-90 (policies toward groundwater mining).

take a long time for improvements to be seen in one state if pumps in another state are shut down. How should such effects be taken into account? States may differ on such matters.

Similarly, how should connections between groundwater and surface water be accounted for, when either or both cross state lines? It is easy — too easy, perhaps — to say that where such a connection exists, groundwater and surface water ought to be managed as a common resource. It is hard to quarrel with the idea that the law governing the resource should recognize that reality. But hydrologic connections vary in strength, and here too effects may be delayed. Some groundwater withdrawals affect streamflows with some immediacy, but some may not affect flow for decades. Judgment is necessary to decide to what extent hydrologically related groundwater ought to be managed with surface water. Here too, states follow very different policies on the subject.<sup>71</sup>

The legal questions that can be raised by interstate groundwater allocations and management bring to mind a fertile law school examination. For example, is it relevant how much each state contributes to the aquifer — how much of the aquifer's total water volume is found under or recharged in each state? In its 1984 decision in *Colorado v. New Mexico*, the Supreme Court made clear that the source of water is basically irrelevant to interstate equitable apportionment law.<sup>72</sup> But that was a surface water case. Would it reach the same result with respect to an aquifer? Even an aquifer that is not hydrologically related to surface water; that is, is in a confined pool much like a petroleum deposit? And even where a state claims it, and not private parties, who owns the groundwater? The answer is not clear.<sup>73</sup> Similarly, an aquifer may recharge at different rates in different places; e.g., recharge of the Ogallala in New Mexico may be faster or greater than in Texas. Ought that be relevant to how the Ogallala's waters are apportioned among the states, or otherwise managed?

Should the quality and effectiveness of the respective states' regulatory programs for managing withdrawals from an interstate aquifer be

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71. *Id.* at 454-68.

72. *Colorado v. New Mexico*, 467 U.S. 310, 323 (1984). The source of water is relevant in resolving controversies to water bodies that cross national boundaries. The Helsinki Rules that restate the law of international watercourses provide that each nation is entitled to a "reasonable and equitable share" in the beneficial uses of the waters in an international water course, and defines "reasonable and equitable" to include, among many other factors, the "contribution of water by each basin State." See SAX, ET AL., *supra* note 1, at 891-92.

73. Only two years before *Colorado v. New Mexico*, in a different context, Justice Stevens credited Nebraska's claim to public ownership of groundwater found in Nebraska as "logically more substantial than claims to public ownership of other natural resources." *Sporhase v. Nebraska*, 458 U.S. 941, 956-57 (1982).

relevant to resolving interstate conflicts? An affirmative answer might seem obvious, but the Supreme Court has sent some decidedly mixed signals on the matter. In *Colorado v. New Mexico*, the Court refused to penalize New Mexico for its lackadaisical management of the flows of the Vermejo River within its borders. It rejected Colorado's claim that better management in New Mexico would have effectively freed up some of the River's water for Colorado's use under the equitable apportionment principles.<sup>74</sup> On the other hand, the Court has said that states "have an affirmative duty under the doctrine of equitable apportionment to take reasonable steps to conserve and even to augment the natural resources within their borders for the benefit of other States."<sup>75</sup> It has also spoken approvingly of effective state regulatory programs in disputes involving water moving across state lines.<sup>76</sup>

How should adverse impacts on the environment, such as on species nurtured in waters supported or influenced by interstate aquifers, be weighed? Here too the law that applies to surface watercourses with interstate dimensions is not completely settled.<sup>77</sup> As noted earlier, however, federal laws like the Clean Water Act and the Endangered Species Act may come into play.

Turning to another set of issues mentioned earlier, how should federal water rights (arising from the *Winters* doctrine) be treated in addressing interstate groundwater issues? Unless expressly provided otherwise, it seems reasonable to expect that federal rights to interstate waterbodies that arise in a particular state should count against that state's apportionment. But this may not always be the case, particularly with respect to federal water rights for Indians.<sup>78</sup> A more important question may be whether the United States will have the political will to vigorously assert and seek to protect federal water rights in the resolution of interstate groundwater disputes. A sobering object lesson here (though it involves international rather than interstate dimensions) is the San Pedro River in Arizona, a small stream with superlative wildlife and biodiversity values. It is gravely threatened by groundwater pumping which is not effectively regulated under

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74. *Colorado v. New Mexico*, 467 U.S. 310 (1984).

75. *Idaho v. Oregon*, 462 U.S. 1017, 1025 (1983) (the resource at stake was salmon, not water, and the Court ultimately refused to intervene).

76. *Sporhase v. Nebraska*, 458 U.S. at 956-57 (1982); cf. *Nebraska v. Wyoming*, 515 U.S. 1, 18 (1995) (giving Wyoming an opportunity to prove, in an equitable apportionment case, that it was injured by the federal government's failure to "police consumption" of water from federal reservoirs in the basin).

77. See *Nebraska v. Wyoming*, 515 U.S. 1, 11-13 (1995); SAX, ET AL., *supra* note 1, at 868, and sources cited therein.

78. See COHEN'S HANDBOOK OF FEDERAL INDIAN LAW § 19.06 (Nell Newton et al. eds. 2005).

Arizona law. Congress has recognized its environmental qualities by designating the river corridor as the Nation's first National Riparian Conservation Area, and investing it with an express federal reserved water right. Enforcing the right to protect the streamflow has, however, been bogged down for two decades in Arizona's seemingly endless effort to adjudicate the water rights of the Gila River system, of which the San Pedro is a small tributary. As a result the stream is drying up.<sup>79</sup>

If an interstate apportionment is made that allows states to draw down an interstate aquifer to such an extent that surface streams, and water rights in those streams (whether based on federal or state law) are adversely affected, should those water right holders be compensated? To the extent state law water rights are defeated by an interstate agreement, compensation is not required as a matter of law. Interstate allocations of water are not, as a matter of law, constrained by the rights to use those waters that have been recognized under the laws of the individual states. This is because a state may use its own law to create rights only in things over which it has sovereign authority, as recognized by federal law.<sup>80</sup> That is, state-law-based rights to use an interstate body of water cannot convey more water than the amount to which that state is entitled as a matter of federal law. Thus, a federal statute or interstate compact could, for example, apportion an aquifer underlying Utah and Nevada in such a way as to defeat Utah-law-based rights to water in, or dependent upon, the aquifer, without providing compensation to those holders of state water rights.

This is not to minimize the effort that holders of water rights under state law will make to avoid this result — exercising political influence over state positions in compact negotiations, equitable apportionment litigation, or in Congress. But it is to say that state water rights-based arguments cannot legally limit how interstate water bodies are apportioned. Further, if a policy decision is made to compensate them, who should pay? And what if compensation is not a sufficient remedy? What result, for example, if a species listed under the federal Endangered Species Act is dependent upon the surface water flows that will dwindle with groundwater pumping?

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79. SAX, ET AL., *supra* note 1, at 465-66. Cf. Dubuc, *supra* note 64, at 191-93 (arguing that federal reserved rights may be the best way to protect the interstate aquifer underlying the Nevada/Utah border from the SNWA export plan); *see also High Country Citizens' Alliance v. Norton*, 448 F. Supp. 2d 1235 (D.Colo. 2006) (federal agencies have judicially enforceable legal obligation to protect federal water rights in appropriate proceedings).

80. *See Hinderlider v. La Plata River & Cherry Creek Ditch Co.*, 304 U.S. 92, 106-09 (1938); SAX, ET AL., *supra* note 1, at 849-50.

### Confronting the Unknown

As the states, the federal government and other water interests begin to grapple with groundwater with interstate dimensions, it will often be the case that much will not be known about these aquifer systems and their connections to surface watercourses. This creates a powerful impulse to adopt a kind of "wait-and-see" approach. This is the position taken by Nevada and the United States in the stipulation that resulted in the dismissal of the U.S. protest of the SNWA's application to appropriate groundwater. This "adaptive management" approach is becoming more common in managing natural resources. While often necessary because of the difficulty of forecasting long-term impacts of actions taken today, it creates a tension between the perceived need for secure authority to proceed with a substantial investment to utilize the resource, and the uncertainty about what environmental impact will follow and how to address that impact once it can be gauged.

Where groundwater extraction (in general, and perhaps especially where interstate groundwater extraction) is involved, if it turns out the impact is significant, by the time this fact becomes known, mitigating it may be difficult, if not impossible. Suppose that, after the SNWA project is built and operates for several years, groundwater pumpers or surface water appropriators in Utah are unable to satisfy their rights. Or suppose the wetlands in a federal protected area in Utah begins to dry up. In each case the evidence points toward the SNWA project pumping as being responsible. Then what? The project will likely have already been sized and built in the expectation that large amounts of groundwater can be pumped. Development in the Las Vegas area will have presumably proceeded on this assumption. Indeed, much groundwater may have already been pumped and delivered before the impact was understood. Finally, if the pumps are shut off once the impact is discovered, the harm may continue for a considerable time, depending on the rate of groundwater movement and recharge.

Possible outcomes at that point include (1) waiving or relinquishing the federal water rights, in effect sacrificing the Refuge's values; (2) providing compensation or mitigation, such as by acquiring or creating new wetlands or a new Refuge with benefits as equivalent as possible to those lost; or (3) using some of the pumped groundwater to keep the Refuge supplied with water, artificially.<sup>81</sup>

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81. The philosophical dimensions of sustaining "natural" landscapes by artificial means were explored in BILL MCKIBBEN, *THE END OF NATURE* (1989, 2006); see also Peter Kareiva, Sean Watts, Robert McDonald and Tim Boucher, *Domesticated Nature: Shaping Landscapes and Ecosystems for Human Welfare*, *SCIENCE*, June 29, 2007, at 1866 (advocating that, because "virtually all of nature is now domesticated," the task



Developing appropriate policies regarding interstate groundwater resources is a major challenge. With many interests at stake, not to mention resources, legal authorities, and influence, the federal government needs to play a key role in the process.

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now is “managing tradeoffs” among the kinds of services ecosystems provide so that “nature and people [can] simultaneously thrive”).

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